Hydrologic Model Manager

Short Name	MODSIM
Long Name	Generalized River Basin Network Flow Model
Description	
Model Type	MODSIM is a continuous river basin simulation model employing an efficient minimum cost network flow optimization algorithm for simulating allocation of water according to water rights, ownership contracts, interstate compacts and other priority mechanisms.
Model Objectives	Provide a comprehensive tool capable of simultaneously simulating both physical operations in a river basin system as well as the administrative and legal structures governing water allocation and use.
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Model Structure	1. The type of the basins for which the model has been developed. MODSIM has been applied to a wide range of basins including municipal raw water distribution systems, river basins dominated by irrigated agriculture, and large-scale interstate basins 2. The size of the basins for which the model applies. There is no basin-scale limitation in MODSIM 3. The nature of simulation that the model undertakes. Simulation in MODSIM is primarily continuous. 4. Components of the hydrologic cycle represented in model formulation. Unregulated inflows, evaporation loss, channel loss, reservoir storage, hydrologic river routing, flow diversion and application, infiltration, and stream-aquifer interactions. 5. The underlying hypotheses (or the type of equations employed) that form the basis of the modeling approach to each component process, including: MODSIM is based on the hypothesis that any complex river basin system can be represented in a network formulation composed of interconnected nodes and links. Storage nodes include reservoirs (both on-stream and off-stream), storage accounts, and groundwater aquifers. Nonstorage nodes include demand locations, points of inflow, diversion, confluence, or any intermediate point to better represent heterogeneity of basin characteristics. Any nonpoint basin characteristic such as channel losses and local storm runoff along a river reach are assumed to be aggregated at one or more nodes. Network links or arcs represent river reaches, canals, pipelines, and drains. The network flow structure is based on linear algebraic equations that conserve mass balance, while maintaining capacity bounds on flows throughout the system. Channel flow routing utilizes Muskingum type equations, while stream-aquifer interactions are calculated using the Glover model or USGS Stream-Depletion Factors. 6. Mathematical formulation of the model components. MODSIM is primarily a deterministic, spatially distributed model
Interception	
Groundwater	
Snowmelt	
Precipitation	
Evapo-transpiration	

Infiltration	
Model Paramters	The primary parameters to be estimated in MODSIM include: channel loss coefficients, groundwater transmissivity and storage coefficients governing stream-aquifer interactions, recharge fractions from water applications, and Muskingum coefficients for hydrologic streamflow routing.
Spatial Scale	In MODSIM, spatial scale is related to the density of nodes in the network formulation. Characteristics of each node and link are assumed to be homogeneous.
Temporal Scale	MODSIM is a continuous simulation model designed to be run in daily, weekly, or monthly time steps. The maximum number of time steps possible in a MODSIM simulation is limited only by the core memory in the computing platform.
Input Requirements	MODSIM provides an intuitive object-oriented graphical user interface for input of all data. The river basin network components are constructed through point-and-click mouse control operations. The MODSIM Window provides menu items for File Control, Editing, General Settings, Utilities, Various View Options, and Help Menus. Data are assigned to each network object of nodes and links by mouse control operations activating spreadsheet style data entry windows for that object. Storage node data include: # Reservoir Name, Minimum Volume, Maximum Volume, and Initial Contents # Reservoir seepage rates # Hydropower efficiency tables related to flow and head on turbines # Target storage tables and operating rules # Reservoir storage priorities and conditional operating rules # Surface area, capacity, head, hydraulic capacity tables # Net evaporation rate tables # Hours of generation for hydropower plants; peak vs. nonpeak generation # Reservoir balance tables, which divide reservoirs into several zones in order to provide balanced operations in a multi-reservoir system Nonstorage node data include: # Node name and Description # Transbasin import # Unregulated inflows # Instream flow (flow-through) demands # Consumptive demands and associated priorities # Infiltration rates irrigation applications # Groundwater pumping capacity # Stream-aquifer characteristics governing streamflow depletion from pumping and return flows from excess irrigation Link or arc data include: # Link name, minimum and maximum capacity # Time variable capacity information # Channel loss coefficients # Costs per unit flow # Water right priority dates # Seasonal capacity limitations # Designation of return nodes for channel losses # Hydrologic routing parameters # Adminstrative information Map view windows may be opened in the MODSIM interface for loading raster and vector maps of the study area. Locations in the map window can be correlated with nodes in the network diagram whereby clicking on a location in the Map view immediately highlights the corresponding node in the network view.
Computer Requirements	MODSIM is available for execution on Intel Pentium or equivalent processors with at least 32 MB RAM running under MS Windows 95, 98, or NT. A Unix version of MODSIM is also available running under X-Window. MODSIM is written in C/C++ and compiled with the Gnu gcc compiler. All code utilized in MODSIM is either native or obtained from public domain sources. No licensing requirements are included with MODSIM, and the model may be downloaded from the following internet site free of charge: ftp://modsim.engr.colostate.edu.
Model Output	MODSIM provides both on-screen and hardcopy graphical plots of time series

	information on: reservoir storage, flow in any link, reservoir releases, inflows, demands, shortages, groundwater contributions, and storage contract informationHEC-1 produces runoff water discharge output with user specified time intervals (minutes/hours). In addition, customized output reports may be generated using the Perl scripting language associated with MODSIM. Perl scripts may also be developed for simulating complex river basin operating rules which are more complex than what is allowed through the normal network structure.
Parameter Estimatn Model Calibrtn	MODSIM does not automatic calibration capability. All calibration is conducted by the user through trial-and-error adjustments, although the graphical user interface incorporated with MODSIM greatly facilitates this process.
Model Testing Verification	MODSIM has been extensively tested and is in current active usage by a large number of organizations and agencies, including private, local, state, federal, and international. Numerous verification procedures have been carried which not only verify the ability of MODSIM to simulate physical operations in a river basin, but also to model complex administrative, legal, and contractual issues.
Model Sensitivity	Generalized sensitivity analyses have not been conducted with MODSIM. All sensitivity studies have been carried out for specific applications of MODSIM.
Model Reliabiity	MODSIM was first developed in the late 1970's, and has undergone numerous updates and improvements since then. The lengthy history of usage of MODSIM over many years by numerous organizations has produced a high degree of confidence in its reliability
Model Application	MODSIM has been primarily applied to water rights evaluation and water supply planning by a number of municipalities, conservation districts, and private engineering consulting firms. MODSIM has also been applied by agencies such as the U.S. Bureau of reclamation for studying instream flow requirements, storage ownership issues, water banking alternatives, group ownership contracts, reallocation of diversion entitlements, and a number of other complex river basin operational and administrative issues. MODSIM has also been utilized for evaluating augmentation plans and exchange agreements governing the conjunctive use of surface water and groundwater. A wide range of studies have been conducted in the South Platte River basin, the Upper Snake River basin, the Lower Arkansas River basin in Colorado, the Poudre River basin, the Colorado-Big Thompson project, the Upper Colorado River Basin, the Gunnison River basin, the Rio Grande River Basin, the Carson-Truckee River system, portions of the Central Valley Project in California, the San Pedro basin in Arizona, and the Cumberland River basin. Several international agencies and organizations have applied MODSIM in South Korea, the Dominican Republic, Brazil, Portugal, Egypt, Canada, Mexico, and Chile.
Documentation	MODSIM relies primarily on on-line documentration and context-sensitive Mosaic style help features in the graphical user interface. Numerous reports and technical papers are available which document the application of MODSIM to a wide range of case studies. User manuals and model documentation are available at the aforementioned web site.
Other Comments	
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